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Running title: Survey of blood transfusion in French speaking anaesthesiologists

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Abstract

Background: There are so far no existing consensus guidelines regarding red blood cell transfusion during paediatric surgery and there is a little information regarding red blood cell transfusion policy among paediatric anaesthesiologists.

Objectives: To determine the transfusion threshold and the volumes of packed red blood cell (PRBC) transfusion among French speaking paediatric anaesthesiologists.

Materials and Methods: A questionnaire of case scenarios was sent to active members of the French Language Society of Pediatrics Anesthesiologists (ADARPEF).

Results: Out of the 324 active members of the ADARPEF, 175 (54%) completed the questionnaire. The threshold for blood transfusion varied from 6 $g.dl^{-1}$ to 12 $g.dl^{-1}$ depending on the scenario. The haemoglobin threshold for blood transfusion and the volume of blood transfused vary among ADARPEF physicians, for the same class of patients. The median [95% CI] haemoglobin threshold for starting blood transfusion was 7.9 [6.9 - 8.9] $g.dl^{-1}$, 7.3 [6.4 - 8.2] $g.dl^{-1}$ and 8.1 [7.0 - 9.2] $g.dl^{-1}$ in the pre-, intra- and post-operative phase respectively. The median [95% CI] PRBC volume transfused was 11.7 [6.6 - 16.8] $ml.kg^{-1}$ and the mean haemoglobin target was 11.6±1.9 $g.dl^{-1}$. Physicians ranked anaemia (99%), underlying medical conditions (95%), hemodynamic instability (89%), haemostasis disorder (86%) and sepsis (79%) as the most significant factors affecting their transfusion decisions. Most paediatric anaesthesiologists (89%) measure the haemoglobin level before PRBC transfusion.

Conclusions: This survey identifies significant differences in transfusion practice patterns among paediatric anaesthesiologists with a median [95% CI] transfusion threshold of 7.6 [6.6 - 8.6] $g.dl^{-1}$ and a median [95% CI] PRBC volume transfusion of 11.7 [16.8 - 6.6] $ml.kg^{-1}$.

Key words: red blood cells, blood transfusion, children, anaemia, haemoglobin, paediatric anaesthesiology

Introduction

Packed Red Blood Cell (PRBC) transfusion is used during both adult and paediatric surgery and resuscitation to maintain an optimal oxygen delivery to organs and tissues in case of significant bleeding. To avoid an overutilization of erythrocyte, the question of when to start blood transfusion, especially in children having hemorrhagic surgery, should be clarified. On the one hand, decisions not to transfuse patients may lead to unnecessary harm due to impaired oxygen delivery and impaired haemostasis [1, 2]. On the other hand, complications associated with transfusion of PRBC are well recognized, including nosocomial infections [3], multiple organ system failure [4], immunosuppression [5] and transfusion-associated acute lung injury [8-9]. The benefit of PRBC transfusion must be weighed against risk. Blood transfusions are administered to increase the blood oxygen carrying capacity [10-11]. Most risks and benefits of PRBC are quite similar in adults and in children. For example, the risk of contracting a viral disease or of developing an adverse reaction after a PRBC transfusion is the same in adults and in children [12]. Meanwhile, the imbalance between needs and availability of blood products has widened. These phenomena have combined to question the traditional indications for transfusion, a debate which is fuelled by the growing concern of clinicians and the public to see the therapeutic indications relying on evidence based medicine. Recommendations have been established on transfusion thresholds in adults [13]. The determination of the thresholds was enabled by research surveys of transfusion practices in adult anaesthesia and resuscitation with studies of morbidity and mortality according to various thresholds transfusions [4]. Thus, clinicians were given recommendations for PRBC transfusion in adult anaesthesia and intensive care based on evidence based medicine [13]. In paediatrics, scientific evidence is so far not available and there are no recommendations for transfusion thresholds. We therefore undertook a survey among French speaking paediatric anaesthesiologists, firstly to determine the transfusion threshold and secondly to assess the volumes of PRBC transfusion in paediatric anaesthesia according to different clinical situations.

Materials and Methods

This survey attempted to give an overview of the use of PRBC in routine practice by French-speaking paediatric anaesthesiologists. As a result, the study was confined to all active members of the Association Des Anesthesistes Reanimateurs Pediatriques d'Expression Francaise (ADARPEF). A postal questionnaire (Table 1), with stamped, self-addressed envelopes, was sent to all paediatric anaesthesiologists who were established members of the ADARPEF. A second mailing was sent with a covering letter 3 months later to all physicians who failed to respond. Non-responders (NR) received a third mailing 6 months later, and were directly contacted by phone by one of the investigators (RJ and TB). Overall, the survey was undertaken between November 2007 and November 2008 and the replies were collated using Microsoft Excel.

A two-part questionnaire was designed. The first part of the questionnaire collected data about: the physician's background; the possibility of documentation of the indication for PRBC transfusion and the general procedure of PRBC transfusion (Annex 1). The second part of the questionnaire described four scenarios of common clinical situations in paediatric anaesthesia, each one containing six questions. The four scenarios are presented in Annex 2. For each scenario, physicians were asked to indicate the lowest haemoglobin concentration resulting in a decision to transfuse RBC (1) before, (2) during (3) and after surgery (4), as well as the volume of PRBC they would transfuse. At the end of each scenario, physicians were asked to indicate which clinical determinants could change their decision regarding PRBC transfusion. Several choices were possible (Annex 3).

Statistical Analysis

For each scenario, the median threshold haemoglobin concentrations for transfusion, as well as the median [95% CI] volumes of PRBC to be transfused, were calculated. A two-way ANOVA was performed to compare the haemoglobin threshold and the volume of PRBC for the different scenarios and the different operative phases, followed by the Student t-test in cases of normal

distribution and the Mann-Whitney U-test in cases of non - normal distribution for continuous variables, whereas Fisher's exact test was used for discrete variables, where appropriate.

Results

Out of the 324 registered ADARPEF members, 175 (54%) returned the questionnaire. Most physicians were experienced, with a mean of 15.5 years of practice in paediatric anaesthesia. Ninety seven percent of the responders had 10 years or more and 37% had more than 20 years experience in the field of paediatric anaesthesia. Thus a majority of the responders were experienced anaesthesiologists. About 9% of the responders worked in private practice while 91% worked in a public hospital. The background and the academic characteristics of the responders, the characteristics of the clinical activity and of the paediatric anaesthesiology unit as well as the type of Post Anaesthesia Care Unit (PACU) employed are listed in Table 1. The characteristics of the red blood cell resources and transfusion practice are listed in Table 2. The practices of PRBC transfusion for each scenario and according to the different operative periods are presented in the figures 1, 2 and 3. The median [95% CI] calculated haemoglobin target was 11.3 [9.8-12.8] $g.dl^{-1}$ for scenario 1, 11.3 [9.7 - 12.9] $g.dl^{-1}$ for scenario 2, 11.2 [9.5 - 12.9] $g.dl^{-1}$ for scenario 3, and 12.6 [9.7 - 15.5] $g.dl^{-1}$ for scenario 4.

Discussion

In this survey we have identified significant differences in transfusion practice patterns among paediatric anaesthesiologists with a median [95% CI] transfusion threshold of 7.6 [6.6 - 8.6] $g.dl^{-1}$ and a median [95% CI] PRBC volume transfusion of 11.7 [6.6 - 16.8] $ml.kg^{-1}$. Anaemia, underlying medical condition, hemodynamic instability, haemostasis disorders and sepsis were the most significant factors modifying the decision to transfuse.

The response rate to the questionnaire was 54%, which is common in mailed questionnaire surveys. The response rate in our study is comparable to the response rate observed in studies performed in the PICU on similar subjects. In fact, the response rate observed in our study is lower than in the study of Laverdiere [14] but approximately the same as in the study of Nahum [15], Hansen [16] and Sacher [17].

The present survey has shown that the volume of blood transfusions among the ADARPEF members varies, ranging from 0 to more than 20 $ml.kg^{-1}$ for the same case scenario. In our study, the median [95% CI] preoperative haemoglobin threshold was about 7.5 [6.8 - 8.2] $g.dl^{-1}$. This value is in agreement with the study of Söderlind's [18] who found a value of 7.5 $g.dl^{-1}$ in children aged 6 to 16 years. This study [18], found that a haemoglobin threshold, called 'magic haemoglobin number' (MHN), was predetermined by about 75% of the clinicians, while the others were using an individual approach. In addition, this MHN was higher for premature babies, but no information was given about the MHN for children who were not premature or under 6 years of age. The other point revealed by our study was that the ADARPEF members tended to accept lower haemoglobin concentrations before starting PRBC transfusion compared to APAGBI (Association of Paediatric Anaesthetists of Great Britain and Ireland) members [18]. This underlines that PRBC policy probably differs from one country to an other and that PRBC transfusion practices have evolved over time, probably in relation to the development of evidence based medicine. In the paediatric intensive care unit (PICU), transfusion triggers ranging from 7 to 13 $g.dl^{-1}$ were reported in one survey [14]. The difference with our survey is probably related to differences in the medical

conditions of the patients hospitalised in the PICU; for example the ASA physical status is probably higher in the PICU population than in common clinical situations of paediatric anaesthesia.

In our study, the median preoperative haemoglobin threshold varies from 6.9 $g.dl^{-1}$ to 8.9 $g.dl^{-1}$ and the postoperative threshold varies from 7.0 $g.dl^{-1}$ to 9.2 $g.dl^{-1}$. As far as we know, there are no existing data regarding this specific point in the literature. These data emphasise the fact the ADARPEF members wait until relatively low haemoglobin levels are reached before starting PRBC transfusion. This level, of 7 to 8 $g.dl^{-1}$, could be an extrapolation to paediatric practice of the AFSSAPS's guidelines of transfusion threshold in adult patients [13, 19].

We hypothesize that the possibility of an haemoglobin level documentation in less than 30 minutes for the majority of the cases (82%), confirmed by laboratory tests before starting PRBC transfusion (89%), could explain why only 39% of the physicians decided to transfuse using solely the Hemocue®, a tool widely available in the operating room (97%) and in the PACU (93%).

In the PICU, many guidelines related to blood transfusion are based on expert opinion, common practice and evidence extrapolated from the studies in adults, rather than on high-quality clinical trials conducted in children [20]. Suggested transfusion thresholds published in textbooks ranged from 4 to 16 $g.dl^{-1}$ according to different underlying conditions [21, 22] but there is no consensus regarding the haemoglobin concentration that leads a physician to prescribe PRBC transfusion in this group [12]. However, taking into account physiopathological considerations, a threshold of 7 $g.dl^{-1}$ might be suggested, since most children are not affected by cardiovascular disease, while the delivery of oxygen to the tissues is thought to be greater in children than in adults [23]. In the PICU setting, the study of Lacroix et al. [24] emphasizes that children may benefit from a restrictive transfusion strategy to minimize PRBC transfusion in paediatric patients with a stable hemodynamic condition. A restrictive transfusion strategy with a haemoglobin threshold of 7 $g.dl^{-1}$ resulted in a 96% reduction in the number of children who had a transfusion exposure and a 44% decrease in the number of PRBC transfusions administered, without increasing the rates of new or progressive Multiple Organ Dysfunction Score in stable critically - ill children [24]. A previous

study, performed with a similar design, has already shown similar results in adults [4]. Another retrospective study has also shown that for children with haemoglobin levels under 9 $g.dl^{-1}$, PRBC transfusions are associated with an increase in resource utilization (oxygen requirements, requirement for mechanical ventilation, requirement for vasoactive agent infusion and increase of PICU and hospital length of stay) [25]. Here there is a major difference with our study because the health status of patients during anaesthesia is different from the health status of patients hospitalized in the PICU. Thus, during surgery the target range after transfusion is usually set higher because bleeding may still be active at the time of blood transfusion and may persist during PRBC administration, at least, until the end of surgery. So, when a paediatric anaesthesiologist decides to transfuse, he may deliberately decide to transfuse more than immediately required (ie more than required according to the actual and the targeted haemoglobin level) taking into consideration the persistent bleeding.

In our survey, we found that about 80% of physicians take the age of the child into consideration to modify the indication for PRBC transfusion. This result is in agreement with the survey by Söderlind et al. [18], although the target age changing the threshold for starting PRBC transfusion is not known with any accuracy. In our survey, the median [95% CI] volume transfused was 11.7 [6.6 - 16.8] $ml.kg^{-1}$ for all scenarios and for the scenarios where children were older than 5 years of age it was 11.1 [6.9 - 15.3] $ml.kg^{-1}$ suggesting a difference in favour of younger children. The cut off age is probably around one year, in agreement with what was shown by Söderlind et al. [18] and confirmed by Lienhart et al. [26]. Taking age into account as an important modifying factor, the median target was 11.3±1.5 $g.dl^{-1}$ for children older than 5 years, whereas in scenario 4, describing a four month old infant, the median [95% CI] target was higher (12.6 [9.7 - 15.5] $g.dl^{-1}$), suggesting that one year of age could be the cutt off, which is in accordance with expert opinion [26]. The fact remains however that, there are no studies in PICU or in paediatric anaesthesia determining precisely which targeted age should be used.

Another consideration relates to the volume of PRBC to be transfused. According to the study by Davies et al. [27], to achieve a targeted haemoglobin value the "transfusion factor" should be taken into account to determine precisely the volume of PRBC which should be infused. One limitation of this study is that it was conducted in the PICU where the problem of the transfused volume is essential because of a potential risk of overloading, whereas during surgery anaemia is acute and often associated with hypovolemia. Thus, if the "transfusion factor" is important in the PICU setting it is less so in paediatric anaesthesia since the aim of the PRBC transfusion is to correct the anaemia, where the risk of overloading is low because of concomitant intraoperative hypovolemia. Interestingly, in our study the determination of the volume to be transfused was based on the following formula in most of the cases (68%): [(Hb expected - Hb measured) x 3)/bodyweight (kg)], where the constant 3 corresponds to the "transfusion factor". The median [95% CI] haemoglobin target in our survey was 11.6 [9.7 - 13.5] $g.dl^{-1}$ and is in accordance with the results observed by Söderlind et al. [18], who proposed a "transfusion target level" of 10 - 12 $g.dl^{-1}$.

The survey by Laverdière et al. [14], found that age, clinical tolerance of anaemia, associated pathology, haemostatic disorder, hemodynamic instability and sepsis could modify the threshold of PRBC transfusion. We have observed similar results and suggest that the most important element modifying the transfusion starter is the clinical tolerance of anaemia because it is the most accessible element during anaesthesia in operating room.

Certain limitations of our study require comment. The first is that it did not involve exclusively paediatric anaesthetists. The second limitation is that responders were quite exclusively French (only 2 responders were not French), despite trying to obtain the maximum of responses. However, we feel that our results still reflect transfusion practices of ADARPEF members, with the ADARPEF including about 85% of French paediatric anaesthesiologists. The third limitation is that our survey is based on voluntary declarations of paediatric anaesthesiologists, while the daily practice of the non responders may be different from the results of our survey. On the other hand, we may assume that the responders are probably those who are most concerned and interested by

PRBC transfusion and that non - responders are seldom exposed to the problem of PRBC transfusion in children. Finally, the fourth limitation is that the survey was a scenario-based study, restricted to the recording of what paediatric anaesthesiologists say they will do rather than what actually happens.

In conclusion, our survey shows that the haemoglobin threshold and the volume for PRBC transfusion vary significantly among French-speaking paediatric anaesthesiologists, for the same kind of patients. The reported median [95% CI] haemoglobin threshold during the pre-operative period was 7.9 [6.9 - 8.9] $g.dl^{-1}$, 7.3 [6.4 - 8.2] $g.dl^{-1}$ in the intra-operative and 8.1 [7.0 - 9.2] $g.dl^{-1}$ in the post-operative period. The declared median [95% CI] PRBC volume transfused was 11.7 [6.6 - 15.8] $ml.kg^{-1}$ and the median [95% CI] haemoglobin target was 11.6 [9.7 - 13.5] $g.dl^{-1}$. The most important factors modifying paediatric anaesthesiologist's decisions were the clinical tolerance of anaemia, an underlying medical condition, the hemodynamic stability, a haemostasis disorder and a sepsis. We also observed that the majority of practitioners want to confirm the haemoglobin level obtained with the Hemocue using laboratory test before starting PRBC transfusion.

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Figure Legends

Figure 1: Haemoglobin threshold for starting blood transfusion in the preoperative period.

Scenario 1: posterior spinal fusion 7 days after an anterior spinal fusion; scenario 2: laparotomy for an appendicular peritonitis without shock; scenario 3: surgical resumption for bleeding on day 7 after a tonsillectomy; scenario 4: acute intussusceptions after failure of conservative management. No significant difference was observed between the different scenarios.

Figure 2: Haemoglobin threshold for starting blood transfusion during the intra operative period.

Scenario 1: posterior spinal fusion 7 days after an anterior spinal fusion; scenario 2: laparotomy for an appendicular peritonitis without shock; scenario 3: surgical resumption for bleeding on day 7 after a tonsillectomy; scenario 4: acute intussusceptions after failure of conservative management. No significant difference was observed between the different scenarios.

Figure 3: Haemoglobin threshold for starting blood transfusion at the end of surgery.

Scenario 1: posterior spinal fusion 7 days after an anterior spinal fusion; scenario 2: laparotomy for an appendicular peritonitis without shock; scenario 3: surgical resumption for bleeding on day 7 after a tonsillectomy; scenario 4: acute intussusceptions after failure of conservative management. No significant difference was observed between the different scenarios.

Responses to the Reviewer(s)' Comments
Response to Reviewer: 1

In order to shorten the manuscript, I suggest that the same questions relative to each of the 4 clinical scenarii be printed only once as Annex 2, and that the last part on the clinical elements that could modify the decision to transfuse be presented as Annex 3.
We agree with the suggestion of Reviewer 1. Accordingly, we have modified the Materials and Methods section of the revised manuscript and we have introduced Annex 2 and 3.

Minor remarks:
- Introduction, L10: Despite the high rate of erythrocyte utilization: what do you mean?
We have modified the sentence to make it clearer. The revised version is: “To avoid an overutilization of erythrocyte, the question of when to start blood transfusion, especially in children having hemorrhagic surgery, should be clarified”.

- Introduction, L18: impaired haemostasis is more caused by haemodilution than by the absence of transfusion of PRBC: please modify.
This sentence has been modified:” On the one hand, decisions not to transfuse patients may lead to unnecessary harm due to impaired oxygen delivery and impaired haemostasis [1, 2].”

- Results, L5-6: Sixteen members did not return the questionnaire and were excluded: this sentence is useless. Or do you mean that these 16 members answered without filling in the clinical questionnaire? This sentence should probably best be deleted.
We agree with the reviewer that this sentence is useless; accordingly this sentence has been deleted.

- Discussion, p9, L2: delete "in critically ill children".
The modification has been done and “in critically ill children" has been deleted.

- Discussion, p9, L42-44: suggesting that one year of age could be the cutt off.
The suggested modification has been done in the revised version of the manuscript.

Figure 1

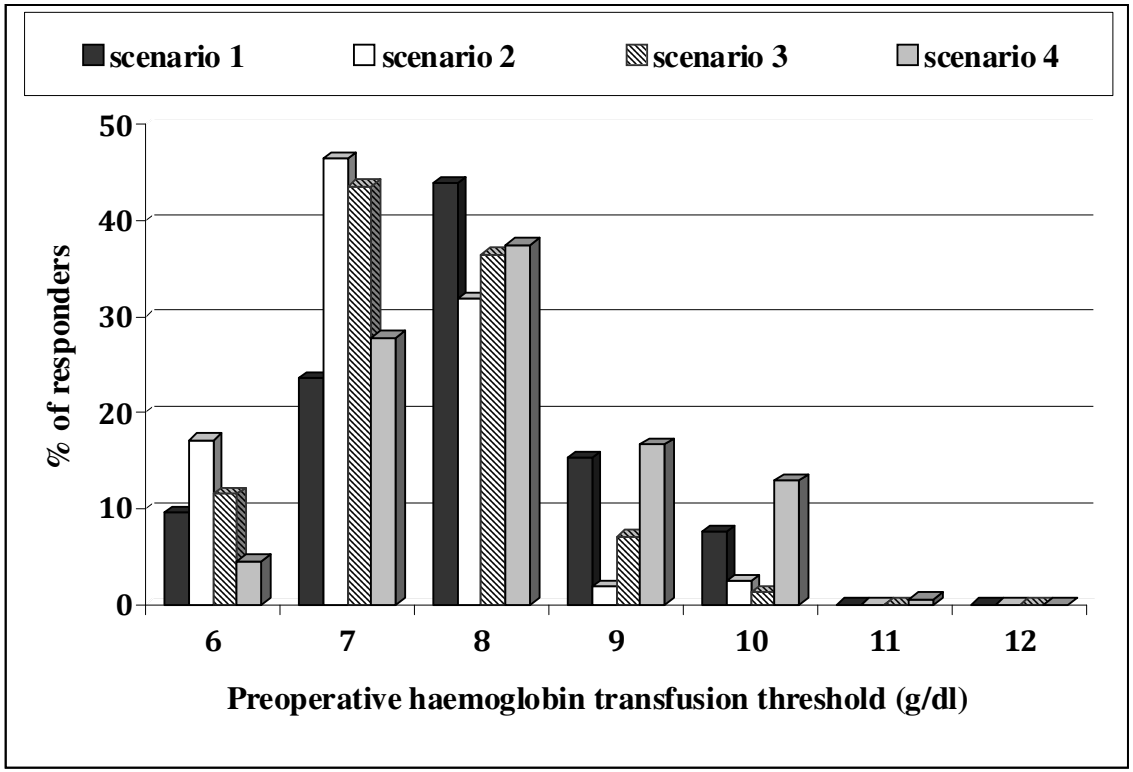

Figure 2

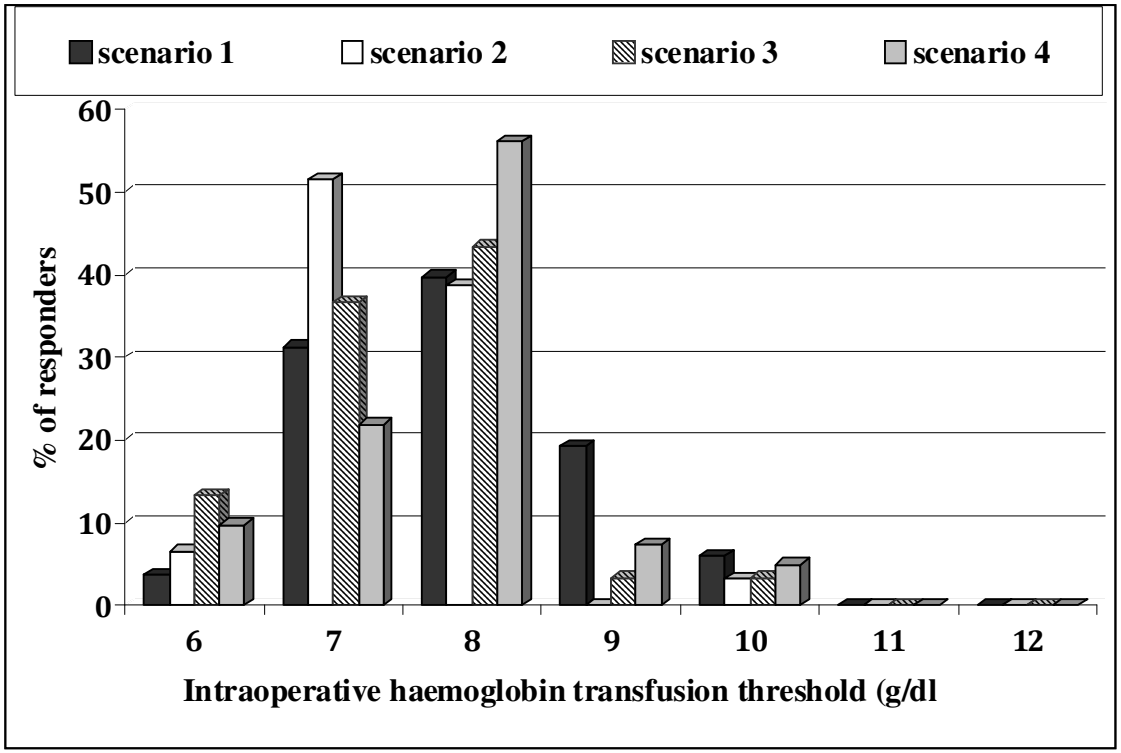

Figure 3

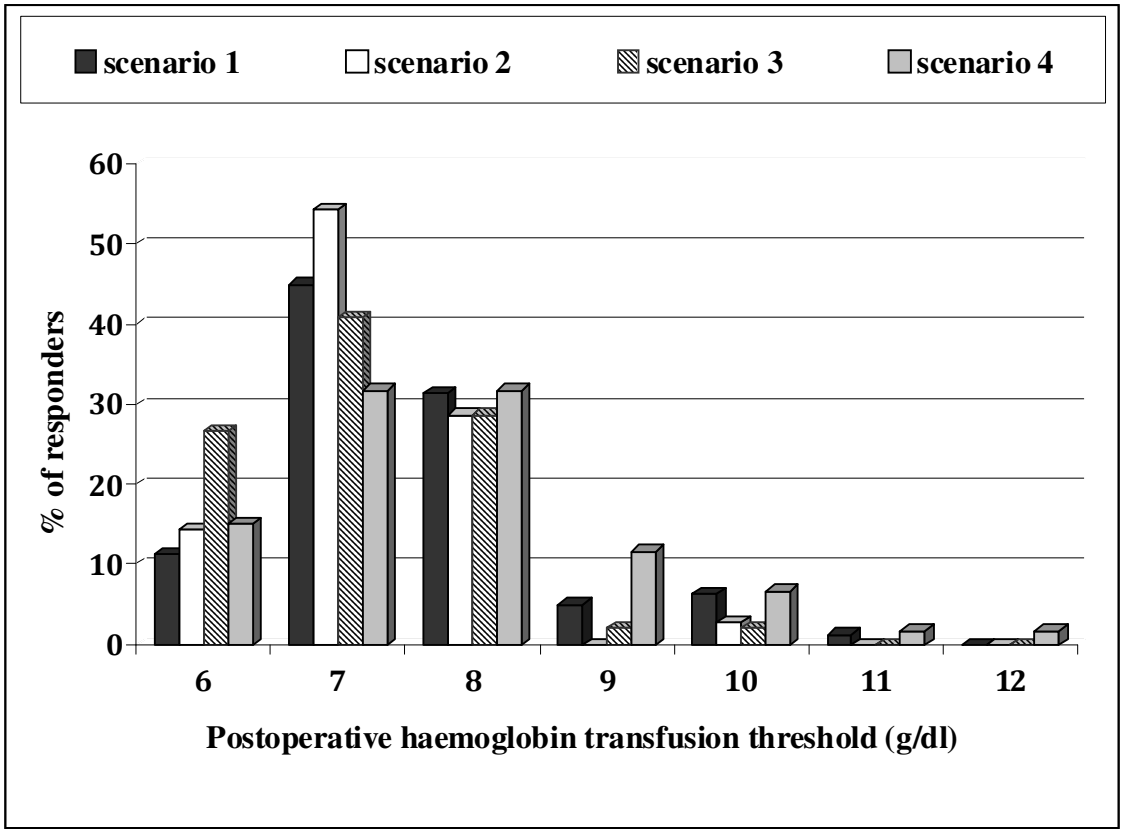

Table 1: Background, academic characteristics and clinical activity of the 175 responders.

Results are expressed in percentage of responders.

Characteristics	% responders
Academic rank	
Professor	5
Associate professor	83
Assistant professor	1
Clinical assistant	2
Liberal anaesthesiologist	9
Numbers of years in paediatric anaesthesiology practice*	
0-4	12
5-9	20
10-14	11
15-20	13
>20	37
Non responders	7
Type of hospital	
University	76
Public non university	11
Liberal	13
Non responders	1
Type of exercise	
Paediatric exclusive	68
Mixed with occasional paediatric activity	17
Mixed with frequent paediatric activity	14
Non responders	1
Type of activity **	
Orthopaedic surgery	88
General surgery	92
Stomatology	79
Cardiac surgery	13
Neurosurgery	35
Ophthalmology	43
Endoscopic procedures	81
Interventional radiology	75
Type of Post Anaesthesia Care Unit	
Dedicated to children	65
Mixed (adult and paediatric)	35
Anaesthesiologist in the Post Anaesthesia Care Unit	
Yes	15
No	85

* Mean duration of practice of responders (m±SD): 15.5±9.7 years

** Number of operating rooms (m±SD): 7±4

Table 2: Characteristics of the red blood cell resources and transfusion practice.

Results are expressed in percentage of responders.

Characteristics	% responders
Reserve of blood	
Bank	59
Deposit	30
None	11
Determination of haemoglobin value in less than 30 minutes	
Possible	82
Not possible	18
Hemocue® in the operating room	
Yes	97
No	3
Hemocue® in the Post Anaesthesia Care Unit	
Yes	93
No	7
Use of laboratory tests to confirm the indication of PRBC transfusion	
Yes	89
No	11
Indication of PRBC transfusion based only on Hemocue® result	
Yes	39
No	61
Determination of the volume of PRBC transfusion based on:	
Formula	68
Body weight	28
Formula and body weight	4
Formula used	
[(Hb targeted - Hb measured) x 3)] / bodyweight (kg)	68
[(Ht targeted - Ht measured)] / bodyweight (kg)	12
Other formula	20
Factors modifying PRBC transfusion practices	
Age	79
Clinical tolerance of anaemia	99
Underlying medical condition	95
Haemostasis disorder	86
Hemodynamic stability	89
Sepsis	79
New intervention during the 7 next days	55

Annex 1: Questionnaire for the survey collecting data regarding physician's background; the possibility of documentation of the indication for PRBC transfusion and the general procedure of PRBC transfusion.

1- Academic rank? (Please select only one answer below)

– Professor
– Associate Professor
– Assistant Professor
– Staff anesthesiologist
– Private practicionner

2- Type of practice? (Please select only one answer below)

– Exclusively paediatric
– Adult mixed with frequent paediatric activity (>50 %)
– Adult mixed with occasional paediatric activity (<25%)

3- Years of practice in paediatric anaesthesia?

4- Type of hospital? (Please select only one answer below)

– University hospital
– Public non university hospital
– Private hospital

5- Number of operating rooms?

6- Type of practice?

– Orthopaedic surgery
– Urology
– Stomatology
– Cardiac surgery
– Neurosurgery

– Ophtalmology

– Endoscopies

– Interventional radiology

8- Type of Post Anaesthesia Care Unit? (Please select only one answer below)

– Mixed (adult and pediatric)

– Dedicated to paediatric patients

9- Anaesthesiologist dedicated to the Post Anaesthesia Care Unit?

– Yes

– No

10- Blood reserve available in the hospital?

– Blood bank

– Blood deposit

– None

11- Possibility of a determination of haemoglobin concentration in less than 30 minutes in the operating room? (Please select only one answer below)

– Yes

– No

12- Availability of an Hemocue® (HemoCue France, Meaux, France) in the operating room?

– Yes

– No

13- Possibility of a determination of haemoglobin concentration in less than 30 minutes in the Post Anaesthesia Care Unit?

– Yes

– No

14- Availability of an Hemocue® (HemoCue France, Meaux, France) in the Post Anaesthesia Care Unit?

– Yes

– No

15- Confirmation of the indication of PRBC transfusion using laboratory test with haemoglobin concentration measurement (excepted in case of immediate urgency)?

– Yes

– No

16- Confirmation of the indication of PRBC transfusion based only on the results of Hemocue® (excepted in case of immediate urgency)?

– Yes

– No

17- Determination of the volume of PRBC transfusion based on? (Please select only one answer below)

– Child's bodyweight

– Formula

– Other

18- In case of use of a formula, which one? (Please select only one answer below)

– [(Hb expected - Hb measured) x 3] / bodyweight (Kg)

– (Ht expected - Ht measured) / bodyweight (Kg)

– Other

Annex 2: The four scenarios of common clinical situations in paediatric anaesthesia and associated questions.

- Scenario 1

A 15-year-old adolescent, weighing 50 kg, ASA physical status 2 and suffering from an idiopathic scoliosis. Currently, 7 days following an anterior spinal fusion, the child is scheduled for the posterior spinal fusion. All the PRBC from autologous donations have already been used. The intervention cannot be postponed. The preoperative hemodynamic condition is stable.

- Scenario 2

A 5-year-old child, weighing 20 kg, ASA physical status 1, undergoing urgent laparotomy for appendicular peritonitis without shock.

- Scenario 3

A 8-year-old child, weighing 25 kg, ASA physical status 2, with asthma (2 to 3 asthma attacks per month, treated by beta 2-agonists and an inhaled corticoid), requires an emergency reintervention for hemostasis 7 days after a tonsillectomy. The hemodynamic status is stable and lung auscultation is normal.

- Scenario 4

A 4-month-old infant, weighing 5 kg, ASA physical status 1, suffering from intussusception with rectal bleeding since several hours. Surgery is required after failure of conservative management.

Questions

1- Before surgery, indicate the lowest haemoglobin concentration resulting in a decision to transfuse RBCs? (Please select only one answer)

6 – 7 – 8 – 9 – 10 – 11 – 12

2- Which volume of blood do you prescribe (specify ml or ml/kg)?

3- Is this threshold different in the intraoperative period?

– Yes

– No

4- If yes, witch threshold do you use in the intraoperative period? (Please select only one answer below)

6 – 7 – 8 – 9 – 10 – 11 – 12

5- Is this threshold different on arrival in the PACU?

– Yes

– No

6- If yes, witch threshold do you use on arrival in the PACU? (Please select only one answer)

6 – 7 – 8 – 9 – 10 – 11 – 12

Annex 3: Clinical determinants of red blood cell transfusion, other than haemoglobin level, that could modify the decision to transfuse.

- Child's age
- Clinical tolerance of anaemia (ex: tachycardia)
- Underlying medical history and associated pathology (ex: cystic fibrosis),
- Coagulation disorder
- Hemodynamic instability
- Associated sepsis
- Need for re intervention during the first 7 postoperative days.

A survey of blood transfusion practice in French speaking paediatric anaesthesiologists

Running title: Survey of blood transfusion in French speaking anaesthesiologists

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Abstract

Background: There are so far no existing consensus guidelines regarding red blood cell transfusion during paediatric surgery and there is a little information regarding red blood cell transfusion policy among paediatric anaesthesiologists.

Objectives: To determine the transfusion threshold and the volumes of packed red blood cell (PRBC) transfusion among French speaking paediatric anaesthesiologists.

Materials and Methods: A questionnaire of case scenarios was sent to active members of the French Language Society of Pediatrics Anesthesiologists (ADARPEF).

Results: Out of the 324 active members of the ADARPEF, 175 (54%) completed the questionnaire. The threshold for blood transfusion varied from 6 $g.dl^{-1}$ to 12 $g.dl^{-1}$ depending on the scenario. The haemoglobin threshold for blood transfusion and the volume of blood transfused vary among ADARPEF physicians, for the same class of patients. The median [95% CI] haemoglobin threshold for starting blood transfusion was 7.9 [6.9-8.9] $g.dl^{-1}$, 7.3 [6.4-8.2] $g.dl^{-1}$ and 8.1 [7.0-9.2] $g.dl^{-1}$ in the pre-, intra- and post-operative phase respectively. The median [95% CI] PRBC volume transfused was 11.7 [6.6-16.8] $ml.kg^{-1}$ and the median haemoglobin target was 11.3 [9.8-12.8] $g.dl^{-1}$. Physicians ranked anaemia (99%), underlying medical conditions (95%), hemodynamic instability (89%), haemostasis disorder (86%) and sepsis (79%) as the most significant factors affecting their transfusion decisions. Most paediatric anaesthesiologists (89%) measure the haemoglobin level before PRBC transfusion.

Conclusions: This survey identifies significant differences in transfusion practice patterns among paediatric anaesthesiologists with a median transfusion threshold of 7.6 [6.6-8.6] $g.dl^{-1}$ and a median PRBC volume transfusion of 11.7 [16.8-6.6] $ml.kg^{-1}$.

Key words: red blood cells, blood transfusion, children, anaemia, haemoglobin, paediatric anaesthesiology